

# **PSS On-Call Guide**

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# PSS On-Call Guide

## 1.0 GENERAL COMMENTS

**BASIC RESPONSIBILITY – ON CALL.** The on-call person should respond within a few minutes during the working day – wear the pager, stay close. Off hours, the on-call person should phone in quickly (15 minutes) and discuss the page. If the problem is confined to a single beamline (minor/serious) then PSS may or may not fix. **All beamline and storage ring downtimes require prompt resolution, unless a delay is approved by management.** ES Group and APS are measured on beamline and storage ring down time and fault rates.

**FLOOR COORDINATORS.** Make sure the **floor coordinator** knows everything you do that impacts PSS operations. This includes keeping the PC and CAT representative informed during lengthy PSS “work”. FC’s phone numbers are 2-0100 for sector 1-4, 2-0200, 2-0300, 2-0400, 2-0500, 2-0800. The FC on duty is at 2-0101 (pager). Please follow the PSS Task Workflow Procedure located on the ISIG-Share Drive/PSS Operations/Procedures. All activity involving PSS requires a “yellow sheet” completed and approved by the floor coordinator. Planned work also requires an approved work request.

**GLOBAL OFF LINE.** In general a beamline is taken GLOBAL OFF LINE if it is having problems. Take a beamline offline before any “work” is done. This is done as follows: Contact either the FC on duty (FCOD), or the sector’s FC. Have them notify the CAT, if you have not already done so. The FC then walks up to the main control room (MCR) and tells APS Operator. APS Operator then walks out to beamline with an “offline” ACIS key. **Fill out the FC’s yellow sheet.**

When a beamline is GLOBAL OFF LINE it should be OK to work on any aspect of the PSS system. Life safety functions are taken over by the Access Control Interlock System (ACIS). However, if you plan to turn off the Chain A or Chain B power supplies, you should contact the PC about PS1 operation.

**GLOBAL ON LINE.** Usually the PSS System Engineer (Nick) brings a beamline back on-line, when all is fixed. This can also be done by Hawkins or Carwardine. Typically the on-call person informs one of these people that the “work” is complete. They may be asked to produce a signed off procedure, depending on the work. PSS brings a beamline on line by signing the sheet in the MCR, and basically telling the MCR person. The FC will request from the MCR that the beamline be put back online. Please follow the PSS Task Workflow Procedure located on the ISIG-Share Drive/PSS Operations/Procedures. When the beamline is back on-line, life safety functions are taken back from ACIS and given to the PSS system.

All RMD’s filed during your on-call time are your problem to follow up. On-Call person should eventually close out the RMD.

## DOCUMENTATION

See the **PSS Hardware and Operations folders in the ISIG-Share drive on “Nickel”** for drawings, procedures (which help you understand why things happen), interface control documents (which are meant for the users, but do help explain the specific sub-system). There are “block diagram” type information on the PSS Hardware, this needs to be improved but some does exist.

See **ISIG-Share drive on “Nickel”**, for the all-important I/O lists for PSS chain A and chain B. It is very likely that you’ll need these to fix a problem. Use the EPICs system to check out faults, if you are away from a screen, ask the floor coordinator to check.

## **2.0 PSS CHAIN A TROUBLE SHOOTING GUIDE**

### **Are there faults?**

What faults exist? (see Appendix A for fault descriptions)

**Major faults** indicate that beam could be going to a non-secured place and human life and safety would be compromised if beam were not interrupted. When a major fault occurs, all shutters in the beamline will slam shut (no sequencing) and Chain A removes the storage ring permit. For example, when a beamline is beam active and a shutter fault occurs (no switch, etc) and any of the stations in the critical section protected by that shutter are not secure, (doors are open, etc) the ring will dump and all the shutters will all close. Beamline should be taken offline to troubleshoot so the rest of the beamlines can start running as soon as possible.

**Serious faults** involve elements within the beamline that control the beam (shutters) or indicate beam status (communication blocks) A fault in these areas is still of great concern, but does not remove beam permits. When a serious fault occurs, effected beamline shutters will close but the storage ring permit is not removed.

**Minor faults** are indications that something in the system (flow, pressure, key position, doors, crash buttons etc) is not providing the expected signal. Minor Faults tend to indicate that maintenance is necessary. Minor faults will close beamline shutters, but the storage ring permit is not removed.

**What conditions (if known) prior to fault?** (i.e.: Love controllers in alarm state, user tried to open shutter, possible power glitch, door was closing)

**What is current status of system?** (i.e.: is whole ring down, do we just need to reset a minor fault, etc)

**What action (if any) has already been taken?** (i.e.: did floor coordinator attempt to clear a minor fault? Is fault recurring?)

**If shutter fault, how many stations are protected by shutter in question?** (how many stations are not producing as a result of this shutter?)

**Are there problems at this beamline outside PSS system ?** (EPS faults, Epics link lost etc)

## **Hardware**

If the system has been running just fine for days, weeks, or months and suddenly does not work, the problem most likely lies in the hardware. Although it is possible that a condition might arise where an undetected error manifests itself in the PSS code, the likelihood is small.

## **Power to PLC Cabinet**

If PLC5 has no power (all lights off):

- If PLC is plugged into a UPS, verify with a meter that the UPS actually supplies 110 V (+/- 10%?) to the PLC. **IMPORTANT: Make sure that you are troubleshooting the right system. Unplugging or powering off any system that is actually alive may cause a ring dump. In the case of FEEPS, this is true even with the beamline off-line.**

If UPS dead:

- Get circuit breaker number displayed in front of the rack and check circuit breakers in the respective panel/column.
- If circuit breakers off, try to turn them on. If UPS /PLCs do not come back up, report problem to System Engineers responsible for the affected systems (PSS/FEEPS/PS).

Verify control power: these are the two white power supplies on the mezzanine. One supplies 24V to the Chain A I/O modules and field devices, and the other supplies 24V to the Chain B I/O modules and field devices. If any of these two power supplies is OFF, verify voltage coming from UPS or UPS itself as explained above.

## **PLC CPU**

The PLC-5 CPU has several indicator lights on its front panel.

- Battery: If the battery indicator is red the battery must be replaced. This battery assures memory is held in the event of a power up but will not cause the PLC to fail. Contact System Engineer to schedule maintenance.
- Run/Fault Light: If the Processor Run/Fault is Red the CPU is not running. The “fault” is in the PLC, not the PLC code. Turning the Major and Minor fault keys won’t help here. Contact System Engineer.
- Force Indicator: If the Force indicator is amber call the system engineer immediately and have the system taken off line. If a force is in the PLC logic the code won’t run. The only way for a force to occur is that someone programs a force onto one of the bits in the logic. Contact System Engineer.
- Channel Status Indicators:
  - The A Light should be steady on (communicating)
  - The B Light should be steady on (communicating)

## **I/O Modules**

The I/O Modules have indicator lights for each input or output on the module. If none of these lights are lit, something is wrong. Either all the inputs (or outputs) are on/off at the same time, or there is no power to the module or the module is defunct. Contact System Engineer.

## **Power Supply**

The power supply is in the far rightmost position on our racks. Each power supply has an indicator light to indicate it is powered (is “on”). The toggle switch near the bottom of the power supply should be in the “up” position. This power supply sends power to the chassis and the I/O modules.

## **DCM Module**

The DCM Module has a power light, two communications lights, and a fault light.

- The Power Light indicates that the module has power.
- The upper comm light indicates serial communications between the module and another (remote) device.
- The lower comm light indicates communication through the chassis to other modules.
- The Fault light indicates that this module has faulted. This will not fault the system, but no EPICS data will be transmitted.

If a problem exists with the DCM module, contact System Engineer.

## **Remote I/O**

Remote I/O will be found in the 15 U cabinets on the experimental floor. Indicators that there are problems with the remote modules would include:

- User LEDs on panel not lit
- An entire station or section (but not entire beamline) isn't functioning

Opening the cabinet will allow for inspection of remote modules for indicator lights.

## **3.0 PSS CHAIN B TROUBLE SHOOTING GUIDE**

Chain B is the redundant PSS PLC chain programmed by Mariana Varotto. Chain B will detect such minor fault issues as DIW water differential pressure and flow.

Chain B will also detect major fault issues: We can determine that the storage ring crashed from chain B because the ACIS (Access Control Interlock System) people tell us so. The following can cause a chain B fault:

- the door-closed rocker switch on a door (chain B switch) goes to open while the station is beam active. A faulty adjustment of the placement of this switch can do this.
- Someone pushes the crash button in a hutch, beam active. The crash button is a double switch, (chains A, B). If the chain B part of the switch, or the connections, are flaky, then the fault can occur.
- The chain B power supply loses voltage. Sometimes we worry (not proven) that if too many strobes and door locks are on, that the power supply may not handle the load, and the chain B system might have a glitch. What was the user doing at the time of the fault?

- Chain B tells ACIS that a fault exists. There is a relay in the ACIS rack to isolate us from them. If this relay has problems, then an incorrect fault state could be sent.
- The ACIS people are John Forrestal (1416) and Roger Hogrefe (1036)

If any of the above occur, then chain B will fault to ACIS. A major fault on chain B will cause ACIS to trip the storage ring. A result of this is that the front end shutters are all ordered to close

### **Chain B (GE 90-70 PLC) Troubleshooting Sheet**

This list is to provide some guidance for a quick response to the most common problems in Chain B. Unless the system is recovering from a major event, there's no need to go sequentially through all of the steps. Instead, refer first to the item that closer describes the problem the beamline is experiencing. Use these guidelines as you would use a first-aid kit; if unsure, ask for assistance.

**IMPORTANT: Make sure that you are troubleshooting the right system. Unplugging or powering off any system that is actually alive may cause a ring dump. In the case of FEEPS, this is true even with the beamline off-line.**

#### **1. No power in PLC, rack or control power**

If GE PLC has no power (all lights off):

- If PLC is plug into a UPS, verify with a meter that the UPS actually supplies 110 V (+/- 10%?) to the PLC (see IMPORTANT note above).
- If UPS OK but PLC still dead, it could be a problem with the PLC power supply (very rare). Contact System Engineer.

If UPS dead:

- Get circuit breaker number displayed in front of the rack and check circuit breakers in the respective panel/column.
- If circuit breakers off, try to turn them on. If UPS /PLCs do not come back up, report problem to System Engineers responsible for the affected systems (PSS/FEEPS/PS).

Verify control power: these are the two white power supplies on the mezzanine. One supplies 24V to the Chain A I/O modules and field devices, and the other supplies 24V to the Chain B I/O modules and field devices. If any of these two power supplies is OFF, verify voltage coming from UPS or UPS itself as explained above.

#### **2. GE PLC, mezzanine – system integrity**

From left to right: 1<sup>st</sup> module is Power Supply (refer to item number 1).

2<sup>nd</sup> module is CPU: the three topmost LEDs must be steady on

- 1<sup>st</sup> LED ON indicates processor is alive (OK)
- 2<sup>nd</sup> LED ON indicates processor is in RUN mode
- 3<sup>rd</sup> LED ON indicates outputs are enabled

If any of these three LEDs is OFF during normal operation, report it immediately to PSS software group.

4<sup>th</sup> LED ON indicates PLC memory is protected. This is not safety critical, but if this LED is OFF, let System Engineer know so that the PLC can be put in mem protected.

3<sup>rd</sup> module is Megabasic, responsible for Epics communication.

- 1<sup>st</sup> LED ON indicates module is alive (OK). If OFF, report it to PSS software group.
- 3<sup>rd</sup> LED flashing indicates module is transmitting. Otherwise, see item number 10 (this is not safety critical)

4<sup>th</sup> module is Genius Bus Controller: the two topmost LEDs must be steady on. If any of these two LEDs is OFF, report it to PSS software group.

- 1<sup>st</sup> LED ON indicates controller is alive (OK)
  - 2<sup>nd</sup> LED ON indicates controller is communicating with remote I/Os. If OFF, refer to control power from item number 1 or Comm Faults from item number 5.10.

5<sup>th</sup> module is first input module. A flashing input (D8) is the watchdog from Chain A. Refer to item number 5.2 if not flashing. Refer to control power from item number 1 if all LEDs OFF.

6<sup>th</sup> module is first output module.

- Storage ring permit is output B6 on output module. If OFF, Refer to item number 7.
- Watchdog to Chain A is output B5. If OFF, report it immediately to PSS software group.
- Shutter permits start from output D1 (%Q00025 from I/O list). If shutter does not open and permit OFF, refer to item number 5.

7<sup>th</sup> module is first input module. Refer to control power from item number 1 if all LEDs OFF.

### **3. Chain B User Panel, LEDs, 15U problems**

Chain B generally controls the APS, Shutter and ACIS red leds, and the door closed leds. Both red and green LED from a given device (shutter, APS key, etc) should not be ON (or OFF) at the same time.

- If all Chain B leds are OFF, refer to control power from item number 1. If control power OK, there might be a Chain B blown fuse on the 15U. Contact System Engineer to schedule work.
- If a door closed led is off (even with the door physically closed): Chain B does not see the closed contact. Contact System Engineer to schedule work.
- If APS leds are both ON (or both OFF): One of the chains sees the beamline APS enable and the other disable. Turn the APS key slowly until one of the two leds changes state. Or, open panel and cover one of the APS key contacts while turning the key, so that only the other contact will be made. This should bring the two chains back in sync).
- If both shutter LEDs are ON (or OFF) at the same time, Chain A or B cannot determine whether the shutter is open or close. There will be some other fault that will help trace the problem.



#### **4. Chain A says “Fault 32, Chain B dead”**

It means Chain A does not see the Chain B watchdog signal. Take a look to the Chain B PLC on the mezzanine.

- If the Chain B PLC is running, check the Chain B watchdog relay output (B5 on output module, mezzanine) and relay number CR39. If output not flashing, contact PSS software group. If relay CR39 not clicking, it needs to be replaced. (\*)
- If the Chain B PLC is truly dead, try item numbers 1 and/or 2.

#### **5. Shutter does not open (with no faults from Chain A)**

Chain B might not be issuing permits for the shutter in question.

Get User Requirements document and Chain B I/O list.

From the first output module on the mezzanine, check Chain B permits to Chain A.

If permit is OFF:

1. Find out how many stations are effectively protected by this shutter; verifying also current beamline configuration: a manual beam stop open or a mode shutter in non-mono mode can affect the size of the critical section.
2. Check watchdog from Chain A, input D8 on 1<sup>st</sup> input module, on the mezzanine, If this input is not flashing, check Chain A PLC. If Chain A alive, check relay CR11 on FERDP backplane (\*). If relay not clicking, it must be replaced.
3. If it's an ID beamline and there are any flows in the stations protected by this shutter, check that the flow inputs are ON, (on the mezzanine), with the help of the I/O list. If input OFF, contact System Engineer to coordinate work with water group.
4. From those stations protected by the shutter, verify Chain B door closed inputs. Check them on the Genius Blocks (15U) with the help of the I/O list. If doors are effectively closed but closed contact not made, contact System Engineer to coordinate work.
5. Verify that all crash buttons are out
6. Station searched signals must be ON on mezzanine. Check this out by using the I/O list.
7. Check that shutter pressure input is ON (mezzanine or 15U).
8. Check that User Key input is ON.
9. Check that APS red led is OFF
10. Comm Faults: First, try a reset by toggling the major key. Check number of faults in Chain B CPU/PLC fault table from Epics. If there are any faults present, check power on the 15U Genius Block modules by following steps from item number 3. If power OK, and faults didn't reset, contact the PSS software group so that they can recover more information about the faults and reset them (this requires the laptop).

#### **6. Chain A faults 67, 112, etc (mistakenly known as “Chain B faults”)**

This might be due to:

- A temporary problem in the shutter. The fault will reset, and it'll be possible to open the shutters again, but the fault may reoccur in a lapse of a few hours or days. Prompt the System Engineer's attention in order to coordinate maintenance work with the vacuum group.
- The intermittent loss of Chain A to B Watch Dog Timer Signal can cause PSS Chain A “No Switch” faults for single cylinders or multiple shutters in a beamline.

- There might be a real, persistent problem with the shutter: *if you try to reset the fault, it won't reset*. Contact System Engineer to coordinate work on the shutter with vacuum group.
- Chain B pulled the permits for the shutter in question, when the shutter was open  
Follow the steps described in item number 5.

#### 7. **Ring dump**

Storage ring permit will be dropped under any of the following conditions, which represent the possibility of personnel exposure: beam into the station and

- station not searched, or
- any door not closed, or
- any crash button pushed

The best way to know the cause of a Chain B ring trip is by getting the status information from the Epics screens. Unless there was a major power or system failure, there must be at least one station beam active (will show red) with a door / crash button problem (will show red) or not searched and secured. Read the documentation or ask for help to interpret the information displayed in Epics.

#### 8. **Epics shows a “Chain B fault “ red dot**

Most of the times this is because there's information stored from an old ring trip (for instance, after validations) that hasn't been cleared. This does not impede the beamline from running (however, after a real trip the beamline may not run until the problem that caused the trip is fixed). Contact the PSS software group to reset.

#### 9. **Epics shows Chain B CPU or I/O faults**

In some cases this could inhibit the beamline from running, Check Comm Faults step from item number 5.

#### 10. **Epics info is white**

This is not safety critical. It means that Epics is not finding some information, in this case from Chain B. Check that Megabasic module on the mezzanine is actually transmitting (third led flashing). If it's not flashing, try resetting the pushbutton on front of the module. Contact Roy Emerson if the problem persists.

#### 11. **“I put the beamline back on-line after a validation/during Acis trip test, and it pages the on-call person saying “Chain B fault”. Does this mean I dumped the ring ?”**

When the beamline goes on line, if there's some storage ring trip information that has been accumulated during the validation, it'll tell the person on call that the information is present. This doesn't mean there was a real trip. If you want to be sure, check the storage ring status from the web.

(\*) Watchdog relay positions have changed in new version of FERDP.

## 4.0 PSS EPICS FAULTS AND SCREENS

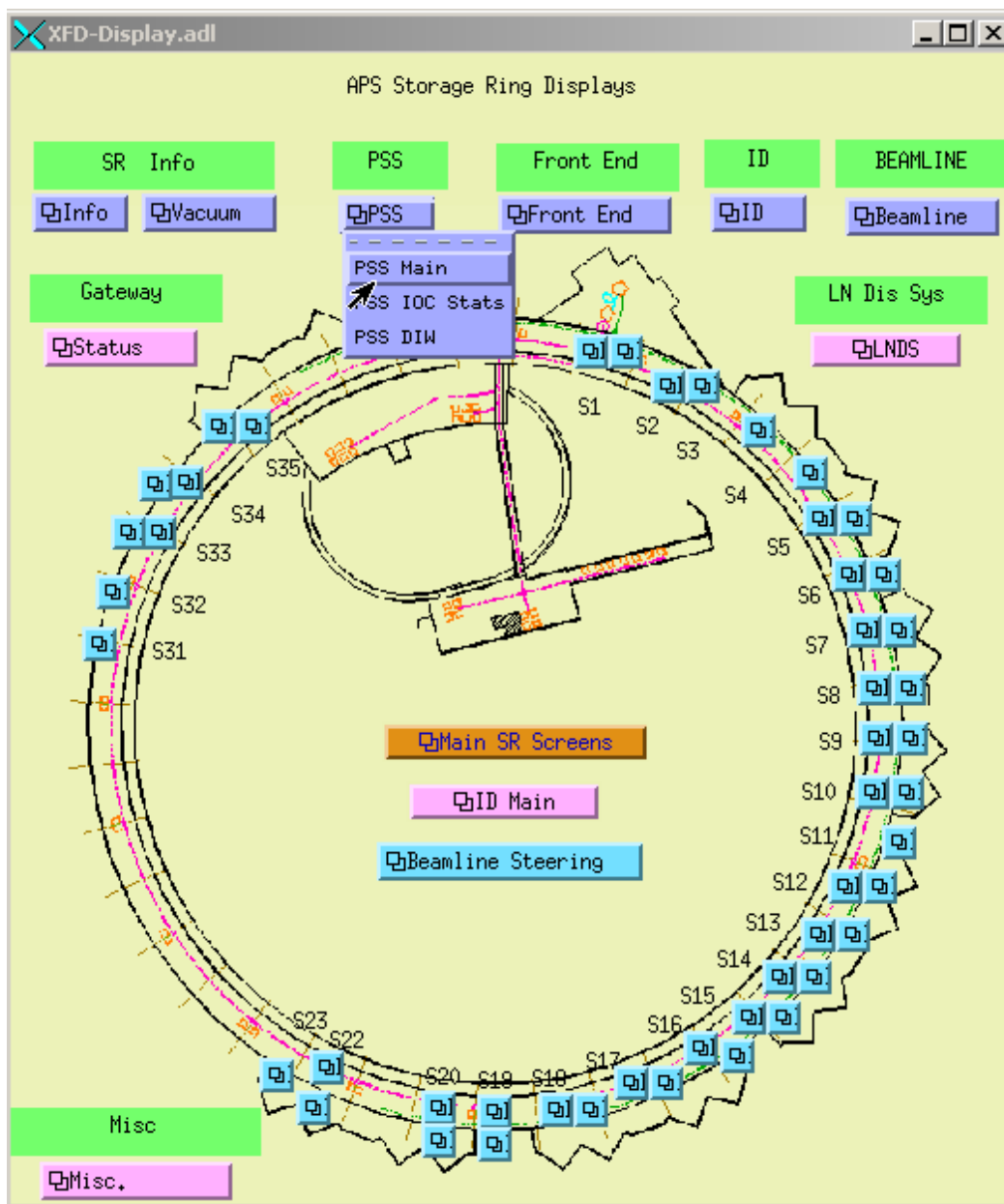
This gives a list of typical epics faults, and a brief discussion of the cause. The same type fault, say “no switch” can occur for any given shutter, and the explanation is not repeated:

<u>PSS Fault #</u>	<u>EPICS Description</u>	<u>Definition</u>
32	pss chain b dead	Chain B seems to be inactive. Power could be off, or the watchdog timer relay could have failed. [see below]
40	chain A power up	
<u>PSS Fault #</u>	<u>EPICS Description</u>	<u>Definition</u>
48	a pshdcr active	Crash button pushed while beam active
49	a opendr active	Door closed switch goes off of true while beam active
50	s2 no switch M	on PS2 shutter, none of the switches are true 10 seconds after shutter command was given. [see below]
51	ps2 both swch M	both shutter open and shutter closed switches are reporting true
52	ps2 mixup M	after ordering shutter to go to open, shutter still closed OR after ordering shutter to go to closed, shutter still open
53	ss1 no switch M	
54	ss1 both swch M	
55	ss1 mixup M	
56	ss2 no switch M	
57	ss2 both swch M	
58	ss2 mixup M	
64	ps1 no switch	
65	ps1 both switch	
66	ps1 mixup	
67	ps2 no switch s (Serious)	
68	ps2 both swch s (Serious)	
69	ps2 mixup s (Serious)	
70	ss1 no switch s (Serious)	
71	ss1 both swch s (Serious)	
72	ss1 mixup s (Serious)	
73	ss2 no switch s (Serious)	
74	ss2 both switch s (Serious)	
75	ss2 mixup s (Serious)	

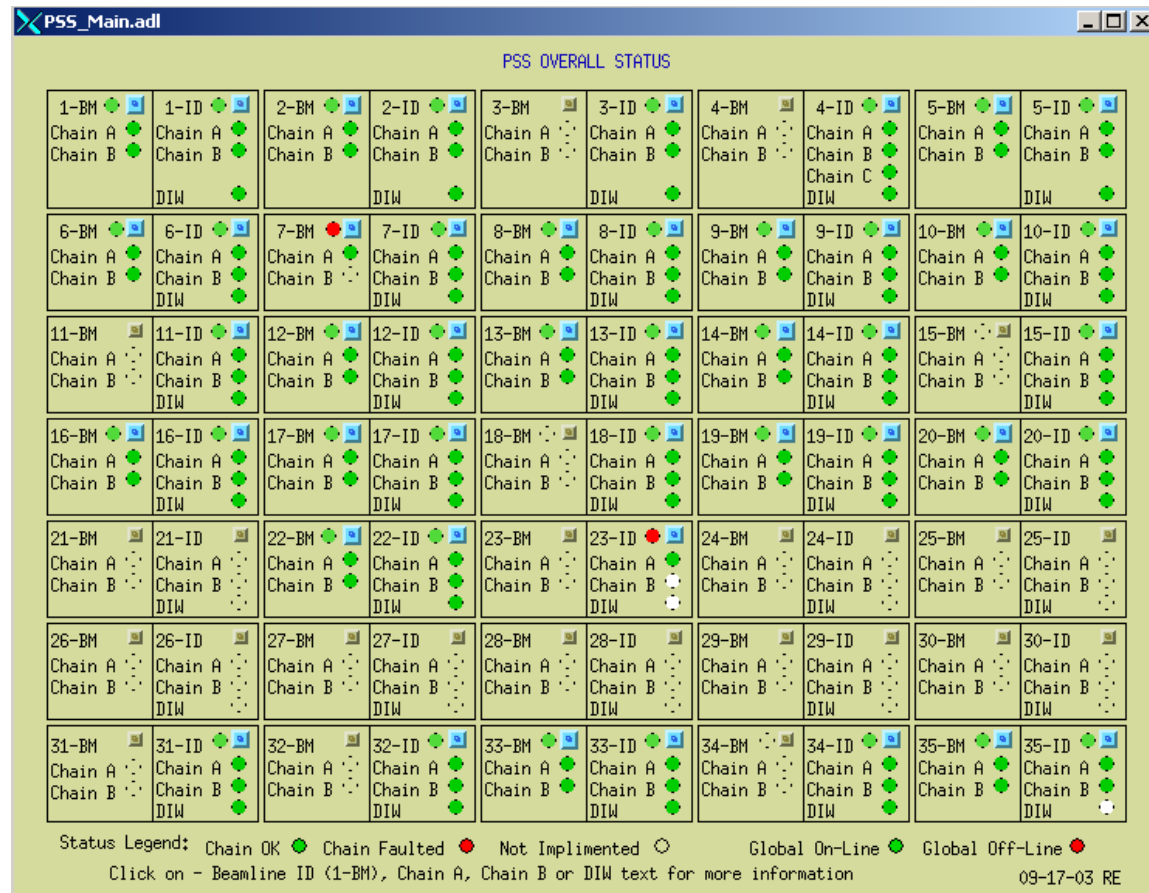
80	a com1 blk fail	the top remote Allen Bradley I/O block has failed
81	a com2 blk fail	the second from the top remote Allen Bradley I/O block has failed
82	a com3 blk fail	
96	b pshdcr active	while the beam was active, the crash button was pushed
<u>PSS Fault #</u>	<u>EPICS Description</u>	<u>Definition</u>
97	b opendr active	while the beam was active, the door closed switch went to not true
112	p5bms1 no switch	
113	p5bms1 both sw	
114	p5bms1 mixup	
115	p5bms2 no switch	
116	p5bms2 both sw	
117	p5bms2 mixup	
128	b com1 blk fail	
129	b com2 blk fail	
130	b com3 blk fail	
384	glbonln to 0	global on line went to not true while beam was active
385	glblbonl fb fault	pressure on the manifold is not tracking the global on line control. That is if global on line, we expect pressure in manifold to be > 60 psi. If global off line we expect pressure in manifold to be < 3 psi.
386	plc key to rem	
387	fe press to 0	
395	a flow to 0	DIW system
396	b press to 0	DIW system
402	a pshdcr secrd	
416	p5b press to 0	
434	b pshdcr secrd	beam is not active, but the station has been searched and secured, and the crash button has been pushed.

### Helpful Epics Screens

The XFD Screen is always your starting point. From here, you'll click on the grey box labeled "PSS" and choose PSS Main from the pull down menu.

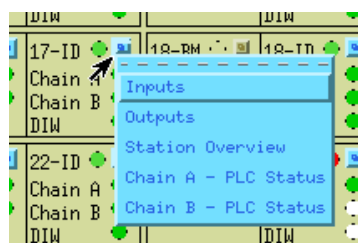


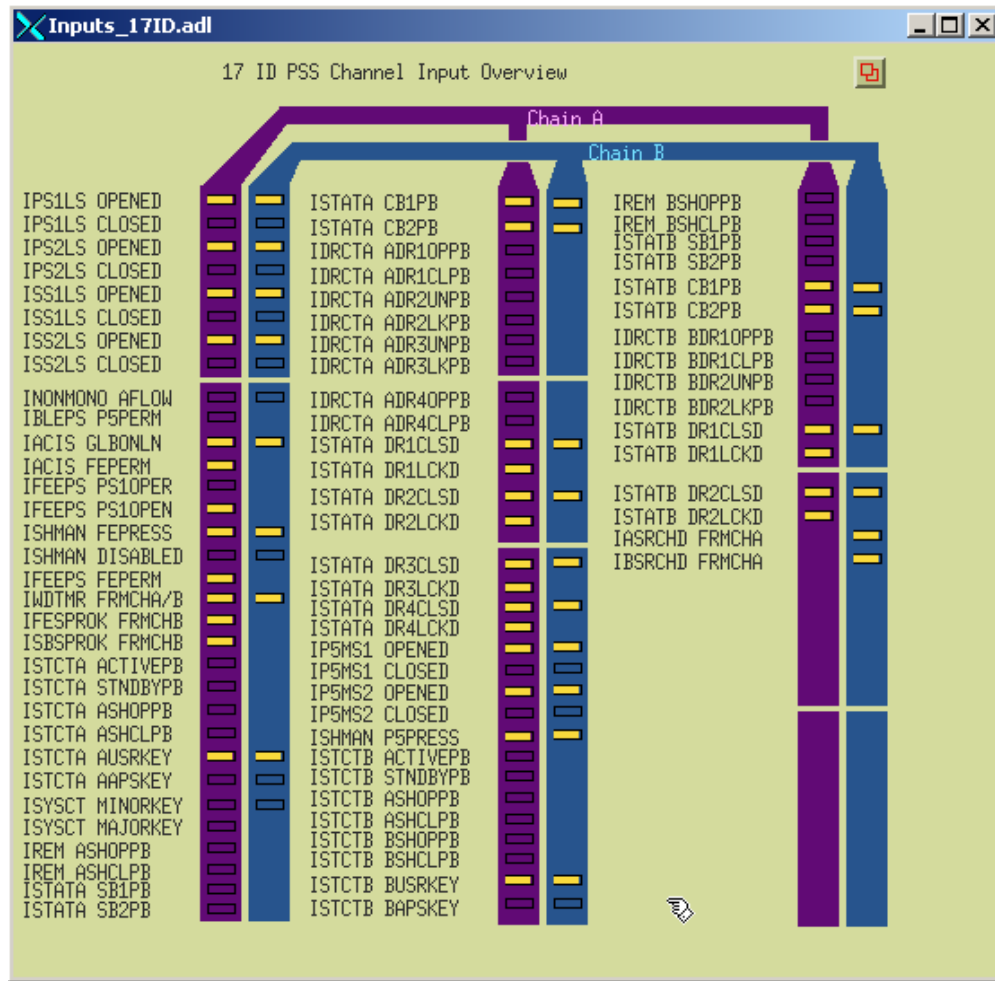
The PSS Main Screen will appear. You can access information on all the PSS systems from this screen. Note the legend on the bottom of this screen.



The “Inputs” Screen will show you which inputs are on for both Chains A and B. This screen will give you detail regarding the current status of all inputs to the system. It will not help you troubleshoot if any signals have returned to their previous state (door opened and caused fault but closed again).

There is also an “Outputs” screen showing both Chain A and B Outputs. These screens are found by clicking on the little blue box in the upper right corner of each individual beamline’s field of the PSS Main Epics screen.





This screen can help you determine if a slow moving shutter switch is the cause of a shutter fault (as opposed to missing signal). If the time shown for a shutter to open or close seems wildly out of line compared to other shutters, it probably indicates a mechanical problem with the shutter. (Cylinder isn't moving easily)

ShtrStats.adl

08-ID Shutter Statistics

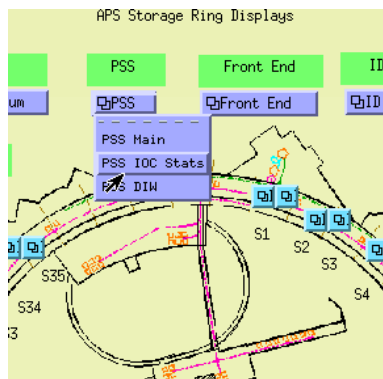
Front End Shutter					# Tables	# Shutters	# Stations	
	Curr Stat	Count	Prev Time	Curr Time	6	3	4	
PS1 OPEN CMD		1						
PS1 CLOSE CMD		0						
PS1 OPEN LS	█	1	0.00	0.79				
PS1 CLOSE LS	▢	3	326.67	326.67				
					INTEGRAL SHUTTER 1 -			
					Count	Prev Time	Curr Time	
USER OPEN PB		19			PS OPEN LS	0	0.00	0.00
USER CLOSE PB		33			PS CLOSE LS	0	0.00	0.00
PS2 OPEN LS	▢	9	0.68	0.68	SS OPEN LS	0	0.00	0.00
PS2 CLOSE LS	█	9	0.33	0.33	SS CLOSE LS	0	0.00	0.00
SS1 OPEN LS	▢	19	1.06	1.05	MS1 OPEN LS	8	0.51	0.52
SS1 CLOSE LS	█	19	0.56	0.55	MS1 CLOSE LS	7	0.33	0.37
SS2 OPEN LS	▢	9	1.09	1.09	MS2 OPEN LS	8	0.47	0.48
SS2 CLOSE LS	█	19	0.48	0.48	MS2 CLOSE LS	7	0.33	0.37
INTEGRAL SHUTTER 2 -					INTEGRAL SHUTTER 3 - P9D			
		Count	Prev Time	Curr Time		Count	Prev Time	Curr Time
PS OPEN LS		0	0.00	0.00	PS OPEN LS	0	0.00	0.00
PS CLOSE LS		0	0.00	0.00	PS CLOSE LS	0	0.00	0.00
SS OPEN LS		0	0.00	0.00	SS OPEN LS	0	0.00	0.00
SS CLOSE LS		0	0.00	0.00	SS CLOSE LS	0	0.00	0.00
MS1 OPEN LS		12	1.05	1.03	MS1 OPEN LS	5	0.60	0.64
MS1 CLOSE LS		11	0.86	0.87	MS1 CLOSE LS	4	0.49	0.48
MS2 OPEN LS		12	1.09	1.07	MS2 OPEN LS	5	0.56	0.56
MS2 CLOSE LS		11	0.86	0.87	MS2 CLOSE LS	4	0.56	0.52

Curr Stat = Current Shutter Limit Switch Status

All Times are in Seconds

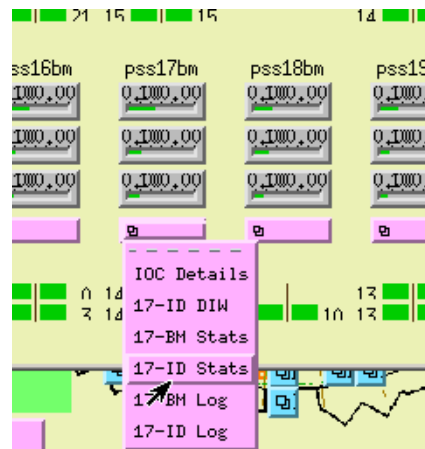
04/15/03 RE

This screen is found by selecting PSS IOC Status from the XFD Display,

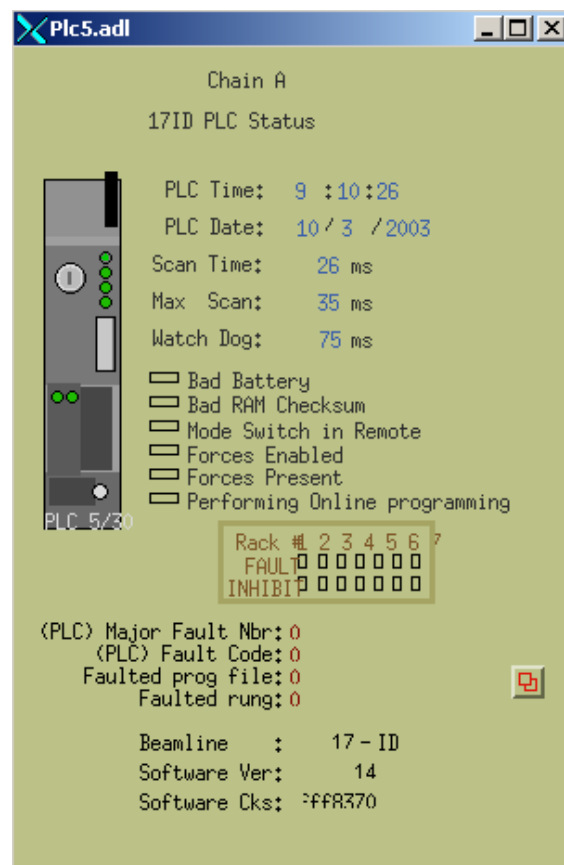




and then clicking on the pink bar below the beamline you are working with and selecting the stats for that beamline (below)



This Epics screen will give you a little detail on the PLC status. This screen is found by clicking the little blue square in the upper right corner of the PSS Main Epics Screen.



## 5.0 MISCELANEOUS PROBLEMS BEAMLINES CAN HAVE

The Vacuum Group is the first point of contact for shutter problems. FCs should call them first.

### Door Operational Problems

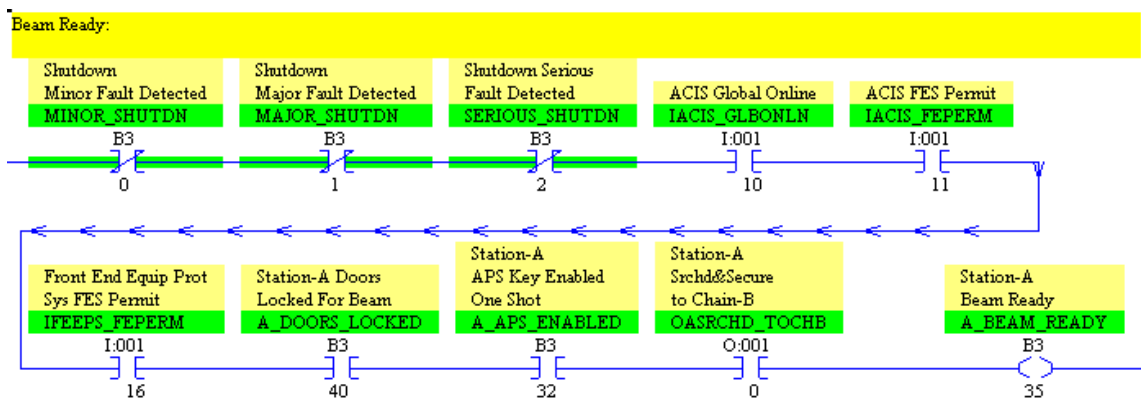
- 1) Door closes, but lock does not engage. Magnetic lock may need adjustment. The “magnetic lock” is stationary, the “magnetic lock bonder” moves with the door. Take a 3/16 inch allen and loosen the magnetic lock perhaps 1 / 4 turn. To loosen, turn the allen bolt CCW as if you were looking downwards. This will allow the magnetic lock bond sensor to move up towards the magnetic lock as the door moves into locked position. The magnetic lock will then properly engage and its bond sensor will signal the green LED to indicate locked. If you loosen too much, the door will hit the lock, not good. Perhaps make it “just” work, then loosen another half turn.
- 2) Door closes, but search is invalid (you can hear the speakers say so). It may be that the door bounced while closing. It closed, the closed light came on (green), then it bounced away from closed (red door closed light flashes briefly), then the door closed light comes back on again as the door finally closes, and magnetically locks into place. Cause may be an improper cushion of air on the door pneumatics. On the door pneumatic closing, there are 2 flathead screwdriver adjustments, one at either side of pneumatics tube. If the door bounces, give more cushion slowing down the last pocket of air from bleeding out quite so fast, thereby avoiding bounce. Do this by closing the screw adjustment (CW).
- 3) Door\_clse\_fail. Hutch number\_DR#\_CLSE\_FAIL. (where hutch number is for example hutch A, where DR# is the door number, for example door 3). This occurs when the station door has been opened using the pneumatic cabinet (outside the hutch, above the door) or egress box (inside the hutch). The PSS system did not tell the door to open. To fix the problem, hit the OPEN button on the PSS door control box. Then reset the minor fault.
- 4) Door won't open and pneumatics seem ok.
  - a. If you press the door open button on an automatic door and heave it open with all your might, it will open eventually unless something is blocking it's movement outside or inside the station. Occasionally, the doors get so far out of alignment that the pressure they put against each other (rubbing) can't be overcome by the hydraulics. Once you get the door open, you'll probably see paint missing from the doors where they rub. You may be able to temporarily align them with a shim, but make sure Tek-nit gets a door alignment order after you're done.

### Shutter Operational Problems

- 1) Any of the shutter switch problems. This is almost always “blow by”, the air in the cylinder pushing the shutter blows by the gasket, and the shutter does not move enough. FC's know this, and should know to contact the Vacuum Group. If work is done on PSS components

then PSS gets involved to validate the system. In general ask the FC to reset the fault, and try again. Does the shutter fail a lot?

- 2) Shutters won't open but I can't figure out why?
  - a. Up in the common area on the first floor (by the secretary's desk and everyone's office) is a cabinet containing copies of the chain A code for each beamline. The cabinet is labeled PSS documents and the individual drawers are labeled PSS Library. The keys to these cabinets are in the PSS lockbox (presently Key 10). Once you find the correct notebook (labeled on the spine), look for the tab labeled "beamline logic." In the beamline logic (file 5) there is a rung of ladder showing which signals comprise the beam ready logic. If you are truly stumped, you can grab this manual and search for this rung. (there's one for each shutter in the beamline – be careful you're looking at the right shutter's rung) The rung will look something like this:



For this particular beamline, you need to make sure there are no faults, that you have the ACIS global online and FE Permit signals, the FEEPS permit, all doors are locked, the APS key is enabled and the station is searched. This rung of logic will vary for every critical section of every beamline, so you need to know what logic is required for the beamline you're working on (thus the need for the book). Everything in this rung of logic should be recorded in EPICS somewhere. Look to see what signals are missing.

### Miscellaneous Problems

- 1) EPICS fault 32. Reset this fault, then schedule to replace the relay. See procedure "Partial Validation for the PSS Watchdog Relay Replacement and System", work in progress Steve Ross.
- 2) EPICS fault 385 If this fault will not reset, it may be because the pressure sensors <3psi >60psi are not true. That is, the exhaust pressure might be greater than 3 psi (fault) or the inlet pressure might be less than 60 psi (fault). One thing to try is to take the beamline global off line. Now the pressure will drop but the logic in the PLC's expect this. Beamline offline, the pressure can be out of range, its not a fault. Now the fault will reset.

If this symptom shows up, then it might be that ACIS is not giving sufficient control current to the pressure solenoid, and it has trouble opening up. Or it could be the solenoid itself.

# Appendix A

## Chain A fault descriptions and possible solutions

**Fault 32** (Chain B Dead) Chain A PLC isn't getting a heartbeat pulse from the Chain B PLC – the likeliest problem is that one of the watchdog relays in the cabinet on the mezzanine is no longer working. This is a Serious Fault. The status of all the watchdog bits in question can be verified using EPICS screens or by viewing LEDs on the PLC modules.

**Fault 40** (Chain A Power Up) Anytime the Chain A PLC powers up, this fault is placed into the fault stack. This fault will show up anytime power is cycled. If you see this fault, Chain A lost power for at least a moment. This is a Major Fault. If there was a known power glitch, (lightening strike, power outage) this may be fine to reset. If the reason for the fault is in question, additional troubleshooting should be done to avoid a second ring dump.

**Fault 48, 134, 192** – Station crash button was pushed when the station was beam active. This is a Major Fault. Either someone is in the station pushing the crash button or a crash button was pressed by falling equipment, or a crash button failed (wire came off?). EPICS screens can assist you in determining which crash button is in question if several exist in the station. (See Appendix C)

**Fault 49, 135, 193** – Station Door opened when the station was beam active. This is a Major Fault. Check EPICS screens to see which door signal is missing. (See Appendix C)

**Fault 50-58** (No Switch, Both Switch, Mix up – MAJOR faults). and Faults **64-75, 112-117, 208-213 etc** (No Switch, Both Switch, Mix up – Serious Faults):

### **MAJOR Faults.**

- 50 PS2 No Switch
- 51 PS2 Both Switch
- 52 PS2 Mix up
- 53 SS1 No Switch
- 54 SS1 Both Switch
- 55 SS1 Mix up
- 56 SS2 No Switch
- 57 SS2 Both Switch
- 58 SS2 Mix up

### **Serious Faults**

- 64 PS1 No Switch
- 65 PS1 Both Switch
- 66 PS1 Mix up
- 67 PS2 No Switch

68 PS2 Both Switch  
69 PS2 Mix up  
70 SS1 No Switch  
71 SS1 Both Switch  
72 SS1 Mix up  
73 SS2 No Switch  
74 SS2 Both Switch  
75 SS2 Mix up  
112, 208, etc MS1 No Switch  
113, 209, etc MS1 Both Switch  
114, 210, etc MS1 Mix up  
115, 211, etc MS2 No Switch  
116, 212, etc MS2 Both Switch  
117, 213, etc MS2 Mix up

(Some stations have three cylinder shutters which extend the fault numbering series)

These faults show up a lot. Many times, they show up as residual faults after Chain-B dumps the ring. Check to see if Chain B dumped the ring first. When they appear alone, it is likely that the problem is in the shutter pneumatics – one of the switches is not moving into position within the expected time limits. This could be due to mechanical reasons (shutter hardware needs adjustment) or because sufficient pressure was not used to move the shutters. If the shutters appear to be the problem, the vacuum group should be involved.

**Faults 80,81,82, 128,129,130, 224, 225, 226** etc These faults appear if communication is lost between remote blocks and the CPU. Either a module has failed or wiring has failed.

**Fault 384** Global Online to 0 - ACIS Global Online signal lost

**Fault 385** Global Online FB Fault Pressure has fallen to less than 3PSI

**Fault 386** PLC Key to Remote. The PLC mode key has been changed to the remote position. If this appears outside of system validation, contact system engineer. Our PSS cabinets have been opened and potentially tampered with.

**Fault 387** FE Press to 0 Front End shutters have lost pressure. Check that pressure valve is not tampered with and that connectors and wiring in the PSS cabinet are good.

**Fault 393** PLC Forced. This should never appear except when testing in validations. If this appears, please contact system engineer. The system cannot be considered safe if someone was able to force bits while system running.

**Faults 395-399** Flow Faults. Flow to components in a station was interrupted.

**Fault 402, 434, 466, 498** Station Crash Button signal lost when station had been secured – check crash buttons and wiring.

**Fault 410, 411, 412, 413, 442, 443, 444, 445, 474, 475, 476, 477, 506, 507, 508, 509**

Station Door Faults – the door is no longer in the closed position and the door open sequence was not initiated. Check door switches.

**Fault 448, 480, 512** Pressure to 0 – An integral shutter has a pressure fault. Check the pressure valves first to make sure no one turned them off.

## Appendix B

### Location of Replacement parts

- PSS** - Safety Interlocks Cabinet #8 L1117  
**FEEPS** - Safety Interlocks Cabinet #6,7, 10 L1109  
 Safety Interlocks Cabinet # 9 Hallway by L1128

## Appendix C

### Love Controller Configuration Procedure

#### CONFIGURATION CHART

**NOTE:** Insure That Jumper Settings on Love Controller Are Configured For **CURRENT INPUT**  
 Hold **INDEX & ENTER** When Powering Up. Press **INDEX** to Scan The Lower Display. Press **UP** or **DOWN ARROW** to Change The Value in The Upper Display. Press **ENTER** to Save Change.

*Old Controller*

LOWER DISPLAY	UPPER DISPLAY	FUNCTION
Hrd1	1	Alarm Hardware: 0=No 1=Yes
Hrd2	6	Output A Hardware: 6=Voltage
Hrd3	3	Output B Hardware: 3=Relay/Logic
OPt1	992	<b>DO NOT PRESS ENTER 992=Serial Communications</b>
CnF1	24	Input Type: 24=4 to 20 mA
CnF2	0	Temp. Descriptor: 0=No Descriptor
CnF3	8	SP1 & SP2 Action: 8=SP1=Output A, dir. act; SP2=Output B, dir. act
CnF4	5	Alarm Type: 5=Absolute High - Low Alarms
CnF5	1	Alarm Action: 1=On-OFF
CnF6	2	Alarm State: 2=Open at SP, LED Flashing
AcPt	Yes	Accept Configuration: Yes=Accept Configuration

Hold **INDEX**. Press **INDEX** to Scan Lower Display. Press **UP** or **DOWN ARROW** to Get The Value in the Upper Display. Press **ENTER** to Save Change

SP1	0.00	Display Decimal Placement
SP2	0.00	Display Decmial Placement



**SECURE MENU**

Hold **UP ARROW** & **ENTER** for 5 seconds. Press **INDEX** to change the lower display. Press **UP** or **DOWN ARROW** to change the value in the display. Press **ENTER** to save change.

LOWER DISPLAY	UPPER DISPLAY	FUNCTION
SECr	4	All Menus May Be Altered( No Security)
InP	Curr	Current Input, 0 To 20 Milliamps
OSUP	On	0% or 20% Suppression For Current or Voltage Inputs
Unit	nonE	No Light is On, Available With Voltage & Current Input
dPt	0.0	Available Only For J, F, E, T, L, RTD's Current, or Voltage
InPt	OFF	Input Fault Timer: Select OFF, 0.1 to 540.0 Min.
SEnC	OFF	Sensor Rate of Change: OFF, 1 to 4000 F, C, or Counts
SCAL	0.0	Max Scale High. Viewable Only For Thermocouple & RTD Inputs. Adjustable For Current & Voltage Inputs
SCAH	*100.0	*Set to Transmitter High. EX. 50, 100, 150 Maximum Scale High. Viewable Only For Thermocouple & RTD Inputs. Adjustable For Current & Voltage Inputs
SPL	0.0	Minimum Adjustment For SP1, SP2, ALL0, ALHi, SP1d, SP2d
SPH	*100.0	*Set to Transmitter HIGH. EX. 50, 100, 150 Maximum Adjustment For SP, SP2, ALL0, ALHi, SP1d, SP2d
SP1o	OutA	Change SP1 & SP2 Hardware Outputs. OutA=SP1 To Terminals 7 & 8, SP2 To Terminals 9 & 10
S10t	Volt	Proportional Voltage, Viewable Only
S1St	dir	Direct Action: Usually For Cooling Applications
S1OL	0	SP1 Output Low Limit: 0 to 90% But, Less Than S1OH
S1OH	100	SP1 Output High Limit: 10 to 102%, But Greater Than S1OL
S1LP	O on	SP1 Lamp On With Output On
S2t	Abs	Absolute Set Point 2 Within SPL & SPH
S20t	OnOF	On/Off Differential. Press ENTER to Adjust SP2d Value For 1 to 7, 1=Linear, 7=Most Non-Linear
S2St	dir	Direct Action: Usually For Cooling Applications
S2LP	O on	SP2 Lamp On With Output On
AL	HiLo	High & Low Alarms: Share Single Contact; Both ALL0 & ALHi Will Be Adjustable.
ALt	Abs	Absolute Alarm Point Within SPL & SPH
ALrE FLOW	OnOF	Automatic Alarm Reset: On/Off type action
ALrE DP	Hold	Manual Alarm Reset: Press & Hold <b>INDEX</b> & <b>DOWN ARROW</b> To Reset
ALPi	OFF	Alarm Power Interrupt: Select On or Off
ALiH	OFF	Alarm Inhibit: Select On or Off
ALSt	OPEn	Alarm Contact Opens At Alarm Point
ALLP	OoFF	Alarm Lamp Off When Contact is Closed
ALbr	OFF	Loop Break Will Cause AN Alarm Condition: Select On or Off
Addr	32	(992 Option) Control Address: Select From 1 to FF Hex
bAUd	9600 19.2	(992 Option) Communications Baud Rate: Select 300, 1200, 2400, 4800, 9600, 19.2, 28.8, 57.6
nAt	OFF	(992 Option) No Activity Timer: Select OFF to 99
CFLT	1	(992 Option) Communications Fault Mode: Select 1 or 2, 1=On Communications Fault Use Local Set Point, 2=Use CFSP

19.2

# SECONDARY MENU

Hold UP ARROW & ENTER. Press INDEX to Scan The Lower Display. Press UP or Down Arrow to Get The Value in The Upper Display. Press ENTER to Save Change.

LOWER DISPLAY	UPPER DISPLAY	FUNCTION
Auto	On	Auto/Manual Control:On=Auto OFF=Manual
ALLo	*20.0 ####	*Set to Values Specified By <del>Craig Conley</del> . <i>Bob D.</i> <i>Mark Road</i>
ALHI	*40.0 ####	*Set to Values Specified By <del>Craig Conley</del> . <i>Bob D.</i>
tunE	Pid	PID is Manually Set
Pid1	50.0	Proportional Band 1:#### Counts For Current/Voltage
OFs	OFF	Manual Reset
rtE	OFF	Rate Time:Select OFF,1, 00.1 to 99.9 min.
ArUP	OFF	Anti-Reset Wind Up Feature:Accumulated Reset Offset is Set to 0% When The Process is Not Within The Proportional Band
ArtE	OFF	Approach Rate:Select OFF, 0.01 to 99.99 min.
PEA	INDEX	Peak(Highest) Input Value:Press ENTER to Reset
VAL	INDEX	Valley(Lowest)Input Value:Press ENTER to Reset
S1Ot	Volt	SP1 Proportional Voltage Output. Viewable Only
SP2d	1.0	SP2 On/Off Differential, 1 to Full Scale Degrees or Counts
PctO	OFF	Percent Output Feature:Select On or Off
Prog	OFF	Ramp/Soak Feature:Select On/OFF
StAt	OFF	Ramp/Soak Status:In Upper Display. On=Full Status Off=Partial Status
1rt	0.00	Ramp Time in Hours/Min.:Select 0.00 to 99.59
1St	0.00	Soak Time in Hours/Min.:Select 00.0 to 99.59
PEnd	OoFF	OoFF= Turn Off All The Outputs at The End of Soak
InPC	0.0	Input Correction:
FiLt	<del>99</del>	Digital Filter:Select OFF,1 to 99. 2=1 sec.
LPbr	OFF	Loop Break Alarm Time:Select Off,1 to 9999 sec.
LOrE	LOC	Local Remote Status:
CFSP	20.0	(992 Option)Communications Fail Set Point
Addr	32	(992 Option)Control Address:Viewed in Hex.

PbL

old

FF

# CONFIGURATION CHART

Hold **INDEX** & **ENTER** When Powering Up. Press **INDEX** to Scan The Lower Display. Press **UP** or **DOWN ARROW** to Change The Value in The Upper Display. Press **ENTER** to Save Change.

LOWER DISPLAY	UPPER DISPLAY	FUNCTION
3dId	3600	
dFLt	FACt	
OP1t	rSPt	
CnF1	Index	Input Type: 24=4 to 20 mA
AcPt	Yes	Accept Configuration: Yes=Accept Configuration

Hold **INDEX**. Press **INDEX** to Scan Lower Display. Press **UP** or **DOWN ARROW** to Get The Value in the Upper Display. Press **ENTER** to Save Change

SP1	0.00	Display Decimal Placement
SP2	0.00	Display Decmial Placement

## SECURE MENU

\*Outputs Are Disabled While Control Is In SECURE MENU

Hold **UP ARROW** & **ENTER** for 5 seconds. Press **INDEX** to change the lower display. Press **UP** or **DOWN ARROW** to change the value in the display. Press **ENTER** to save change.

LOWER DISPLAY	UPPER DISPLAY	FUNCTION
SECr	4	All Menus May be Altered( No Security)
InP	Curr	Current Input, 0 To 20 Milliamps
OSUP	On	0% or 20% Suppression For Current or Voltage Inputs
Unit	nonE	No Light is on, Available With Voltage & Current Input
dPt	0.0	Available Only For J, F, E, T, L, RTD's Current, or Voltage
InPt	OFF	Input Fault Timer: Select OFF, 0.1 to 540.0 Min.
SEnC	OFF	Sensor Rate of Change: OFF, 1 to 4000 F, C, or Counts
SCAL	0.0	Max Scale High. Viewable Only For Thermocouple & RTD Inputs. Adjustable For Current & Voltage Inputs
SCAH	*50*100 *150	*Set to Transmitter High. EX. 50, 100, 150 Maximum Scale High. Viewable Only For Thermocouple & RTD Inputs. Adjustable For Current & Voltage Inputs
SPL	0.0	Minimum Adjustment For SP1, SP2, ALLO, ALHI, SP1d, SP2d
SPH	*50*100 *150	*Set to Transmitter HIGH. EX. 50, 100, 150 Maximum Adjustment For SP, SP2, ALLO, ALHI, SP1d, SP2d
SP1o	OutA	Change SP1 & SP2 Hardware Outputs. OutA=SP1 to Terminals 7 & 8, SP2 to Terminals 9 & 10
S1St	dir	Direct Action: Usually For Cooling Applications
S1OL	0	SP1 Output Low Limit: 0 to 90% But, Less Than S1OH
S1OH	100	SP1 Output High Limit: 10 to 102%, But Greater Than S1OL
S1LP	OoFF	SP1 Lamp On With Output On
S2t	Abs	Absolute Set Point 2 Within SPL & SPH
S2St	dir	Direct Action: Usually For Cooling Applications
S2OL	0	Set Point Output Low Limit in Percent
S2OH	100	Set Point 1 Output High Limit in Percent
S2LP	on	SP2 Lamp On With Output On
AL1	HiLo	High & Low Alarms: Share Single Contact; Both ALLO & ALHI Will be Adjustable.
A1t	Abs	Absolute Alarm Point Within SPL & SPH
A1rE FLOW	OnOF	Automatic Alarm Reset: On/Off type action
A1rE DP	Hold	Manual Alarm Reset: Press & Hold INDEX & DOWN ARROW To Reset
A1PI	OFF	Alarm Power Interrupt: Select On or Off
A1IH	OFF	Alarm Inhibit: Select On or Off
A1St	OPEn	Alarm Contact Opens At Alarm Point
A1LP	OoFF	Alarm Lamp Off When Contact is Closed
A1Lb	OFF	Loop Break Will Cause AN Alarm Condition: Select On or Off
Addr	*1*2*3	* Count from left to right the Love Controllers installed Starting with 1,2,3 ect. (992 Option) Control Address: Select From 1 to FF Hex
bAUd	19.2	(992 Option) Communications Baud Rate: Select 300, 1200, 2400, 4800, 9600, 19.2, 28.8, 57.6
nAt	OFF	(992 Option) No Activity Timer: Select OFF to 99

## SECONDARY MENU

Hold **UP ARROW** & **ENTER**. Press **INDEX** to Scan The Lower Display. Press **UP** or **Down Arrow** to Get The Value in The Upper Display. Press **ENTER** to Save Change.

LOWER DISPLAY	UPPER DISPLAY	FUNCTION
A1Lo	*20.0 ####	*Set to Values Specified By <del>Craig Conley</del> . <i>Bob</i> Low Alarm:Adjustable Within The Values of SPL & SPH
A1HI	*40.0 ####	*Set to Values Specified By <del>Craig Conley</del> . <i>Bob</i> High Alarm:Adjustable Within The Values of SPL & SPH
Out1	10tp	Output Selection. Time Proportioning Cycle Time
Out2	ProP	Output Selection. For Current (Code 5) Output Only
tun	Pid	PID is Manually Set
Pb1	1	Proportional Bandwidth
Pb2	1	Proportional Bandwidth. Appears Only if Control is Equipped With Second Set Point and OUT2 is Not Selected
OFS	OFF	Manual Reset
rtE	OFF	Rate Time:Select OFF,1, 00.1 to 99.9 min.
Pid2	0	Linkage of PID Parameters Between SP1 and SP2
ArUP	OFF	Anti-Reset Wind Up Feature:Accumulated Reset Offset is Set to 0% When The Process is Not Within The Proportional Band
ArtE	OFF	Approach Rate:Select OFF, 0.01 to 99.99 min.
Fint	0	Fuzzy Logic Intensity. 0=Off
Fbnd	0	Fuzzy Logic Error Band.
FrtE	0.00	Fuzzy Logic Rate of Change
PEA	INDEX	Press <b>INDEX</b> Key Peak(Highest) Input Value:Press <b>ENTER</b> to Reset
VAL	INDEX	Press <b>INDEX</b> Key Valley(Lowest) Input Value:Press <b>ENTER</b> to Reset
PctO	OFF	Percent Output Feature:Select On or Off
InPC	0.0	Input Correction:
FILT	OFF	Digital Filter:Select OFF,1 to 99. 2=1 sec.
LPbr	OFF	Loop Break Alarm Time:Select Off,1 to 9999 sec.
LOrE	LOC	Local Remote Status:
Addr	32	(992 Option)Control Address:Viewed in Hex.

## **Appendix D**

### **PSS I/O Names List**